



Liebert® EFC

from 100 to 450 kW

The Highly Efficient Indirect
Evaporative Freecooling Unit



Liebert® EFC from 100 to 450 kW

Vertiv™ brings together hardware, software, analytics and ongoing services to ensure its customers' vital applications run continuously, perform optimally and grow with their business needs.

Vertiv solves the most important challenges facing today's data centers, communication networks and commercial and industrial facilities with a portfolio of power, cooling and IT infrastructure solutions and services that extends from the cloud to the edge of the network.

Headquartered in Columbus, Ohio, USA, Vertiv employs around 20,000 people and does business in more than 130 countries. For more information, and for the latest news and content from Vertiv, visit [Vertiv.com](https://www.vertiv.com).

Liebert® EFC, the Highly Efficient Indirect Evaporative Freecooling Solution

The **Liebert EFC** is equipped with the most advanced industry technology. The system includes indirect air-to-air heat exchange and evaporative cooling technology all in one footprint. The Liebert EFC is capable of reducing air temperatures by leveraging on the evaporative cooling principle.

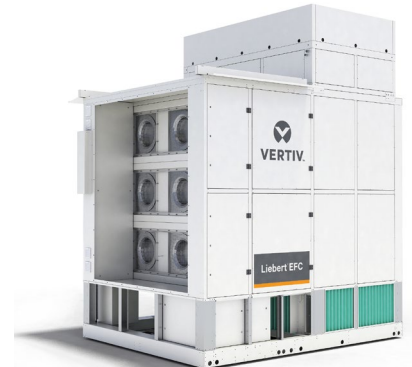
The process involves the evaporation of water which, as a consequence, cools the surrounding air. Through this technology, the Liebert EFC can thus achieve pPUE levels of 1.03 ensuring top energy efficiency, as well as minimized operating costs.



Liebert EFC 220



Liebert EFC 300



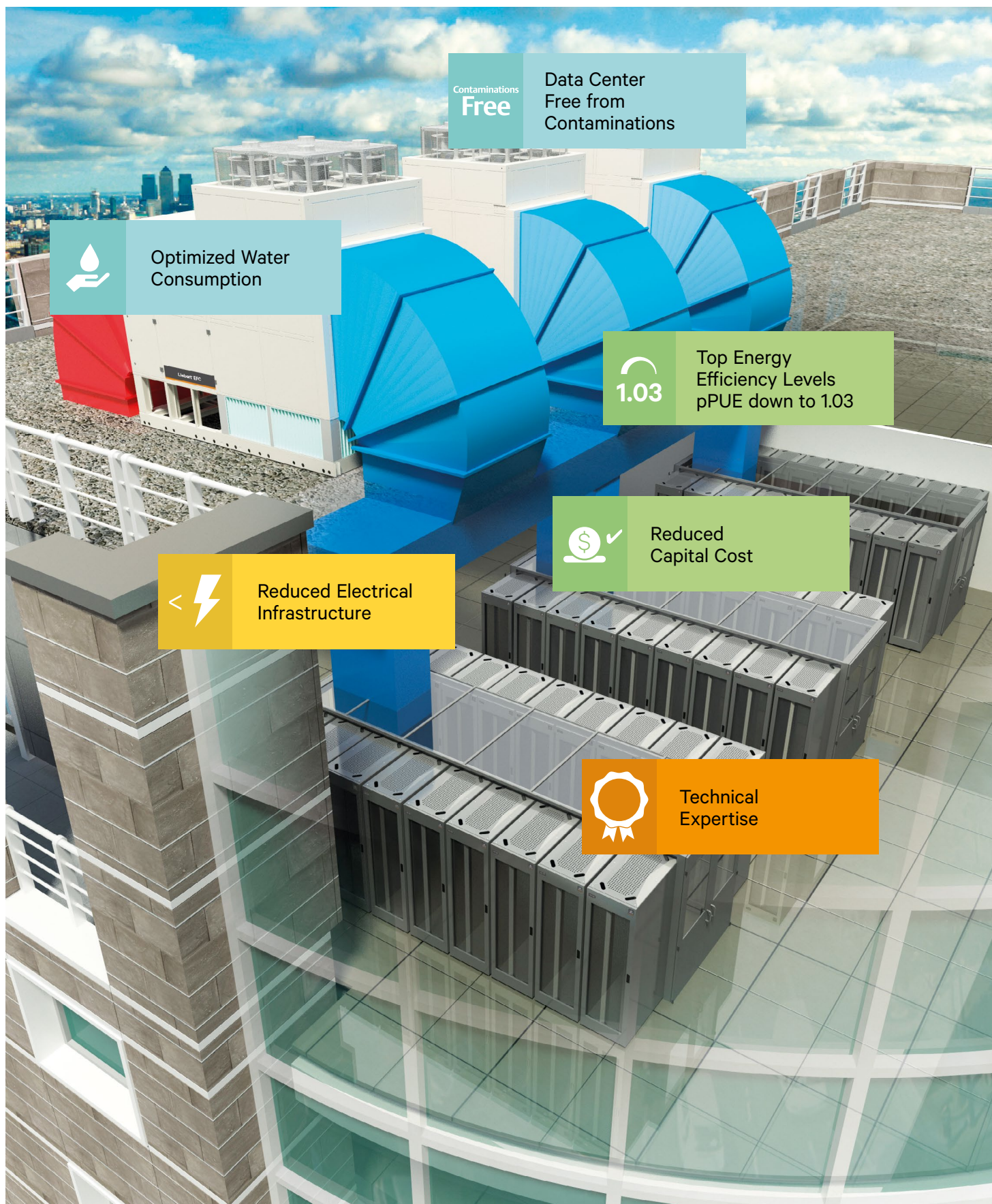
Liebert EFC 320




Liebert EFC 400




Liebert EFC 440




Contaminations
Free
Data Center
Free from
Contaminations

 Optimized Water
Consumption

 Top Energy
Efficiency Levels
pPUE down to 1.03

 Reduced
Capital Cost

 Reduced Electrical
Infrastructure

 Technical
Expertise

Supplying indirect freecooling for data center applications via the evaporative technology.

Liebert® EFC: Enhancing Data Center Efficiency



Evaporative Cooling

The highly efficient evaporative system sprays water onto the heat exchanger to enable cooling even at high ambient air temperatures, without the need for mechanical cooling.



Energy Efficiency

The evaporative cooling technology enables Liebert EFC to reach pPUE levels as low as 1.03.



Highly Efficient EC Fans

The new generation of fans installed in the Liebert EFC dramatically reduce the noise level and increase the overall efficiency of the unit.



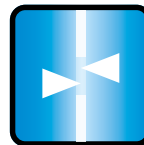
Eurovent Certified Heat Exchanger

Eurovent certification guarantees that Liebert EFC heat exchangers undergo independent testing, thus delivering rating accuracy and enhancing the unit's reliability.



Reduced CO₂ Emissions

At pPUE levels of 1.03, Liebert EFC requires minimum power input consequently reducing CO₂ emissions.



Freecooling

Evaporative cooling extends indirect freecooling operation all year round.



Data Center Free from Contaminations

The air-to-air heat exchanger separates external and internal air, protecting the data center air from bacterial contamination, as well as other external events such as fire and pollution.



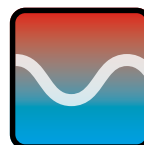
Integrated Chilled Water Coil and Direct Expansion System

These technologies ensure the unit's operation even in climates characterized by extreme humidity levels or severe temperature peaks.



Liebert® iCOM™

Liebert® iCOM™ Control ensures high level management of the units to work together as a single system, thus optimizing room temperature and airflow.



Partial Load Efficiency

New generation EC fans and integrated digital scroll compressors contribute to achieving the highest efficiency levels at partial load.



The evaporative system has a dedicated internal pump that provides the water needed. Water is sprayed through special nozzles onto the heat exchanger and evaporates, thus humidifying and cooling the air.

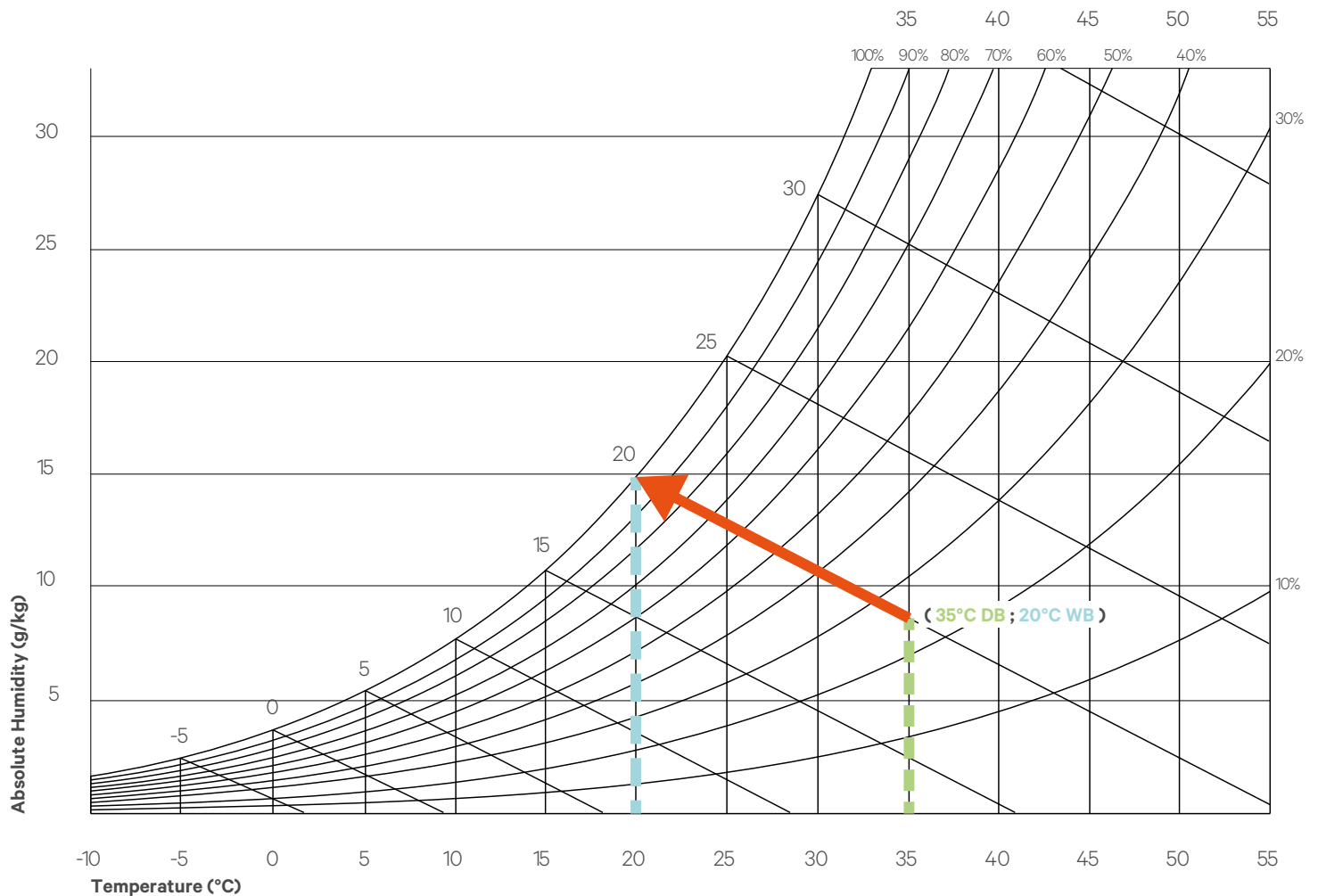
Ensuring Top Efficiency Levels through the Evaporative Principle

The Liebert® EFC combines the capabilities of freecooling and evaporative cooling principles in one single unit. It has been specifically designed to select the most appropriate operating mode based on the external environment conditions, leveraging both principles in order to deliver significant energy savings.

The use of the evaporative cooling, hence using cold external air as a means of cooling, allows freecooling operation to be maximized and compressor-related cooling to be reduced to a minimum, thus optimizing operating costs.

The evaporative principle uses air to absorb water that is sprayed through special nozzles onto the heat exchanger. Water evaporation, thus removes heat from the air and cools the outside air temperature.

Outside air consequently transitions from Dry Bulb Temperature to Wet Bulb Temperature (the graph below shows the transition from 35°C to 20°C).



Psychrometric Chart for Sea-Level Elevation

Where Indirect Evaporative Cooling Works

In order to optimize the overall system efficiency, the Liebert® EFC has been designed to change its operation mode according to the external environment. When the external air is cold enough to allow freecooling, the unit works in dry operation mode (winter operation mode).

When ambient temperatures are higher, also external humidity determines unit capacity and performances as the evaporative effect is directly associated to the external air capacity to absorb water.

When the unit operates in environments with higher temperature and lower relative humidity (summer operation mode), Liebert EFC works in evaporative (wet) mode.

In climates featuring high levels of humidity the unit may thus require the integration of a Direct Expansion (DX) system or the installation of a Chilled Water (CW) coil (extreme operation mode).

DRY OPERATION (Dry Bulb Temperature <math><17^{\circ}\text{C} - 20^{\circ}\text{C}</math>)*

The unit can cool the data center solely via the air-to-air heat exchanger, thus using only cold external air.

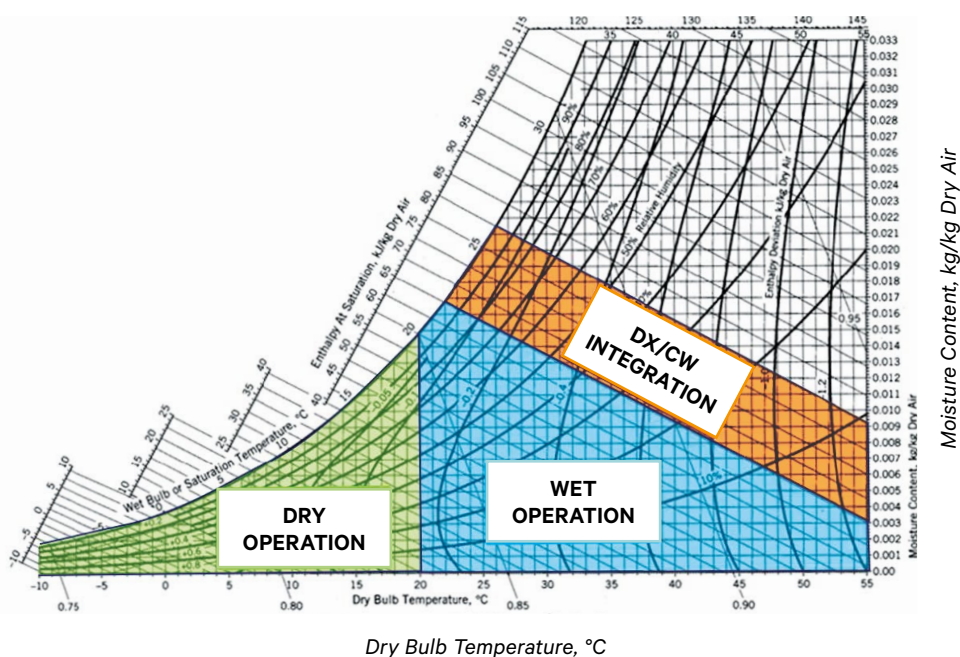
WET OPERATION (Wet Bulb Temperature <math><20^{\circ}\text{C} - 22^{\circ}\text{C}</math>)*

The unit can leverage the evaporative effect via humidification.

DX/CW INTEGRATION

External humidity assumes a key role in determining unit performances:

- At 24°C and 90% relative humidity, the unit may require DX/CW integration.
- At 35°C (higher temperature) and 25% (lower relative humidity), the unit can solely operate with evaporative cooling.

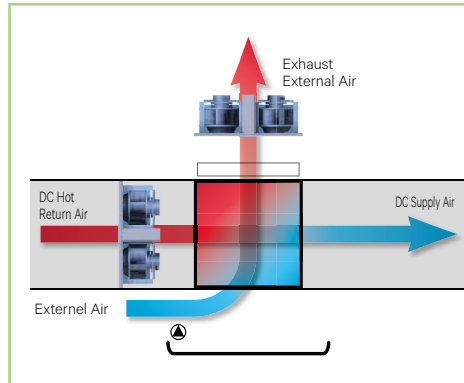


*Assumptions: data center 36°C → 24°C - 100% of full load per unit (redundancy operation)

Liebert® EFC Operation Modes In Detail

Winter

The use of the evaporative cooling, hence using cold external air as a means of cooling, allows freecooling operation to be maximized and compressor-related cooling to be reduced to a minimum, thus optimizing operating costs.

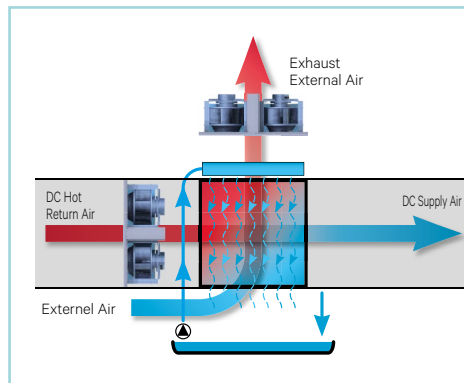


DRY OPERATION

Air-to-Air Heat Exchange Without Spraying Water

Summer

During the warm season (summer operation mode) the evaporative system must run in order to saturate the air. This enables the unit to cool the data center air even with high external air temperatures. By saturating the air, the dry bulb temperature can be reduced.

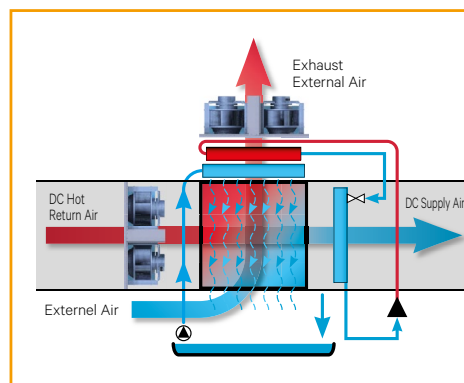


WET OPERATION

Air-to-Air Heat Exchange Via the Spraying of Water to the External Air Side

Optional

In case of extreme external conditions, a Direct Expansion (DX) system is available to provide additional cooling. As an alternative, the Chilled Water (CW) coil can be installed. DX and CW systems are sized to provide partial back up for the overall cooling load and are designed to provide maximum efficiency with minimum energy consumption.



DX/CW INTEGRATION

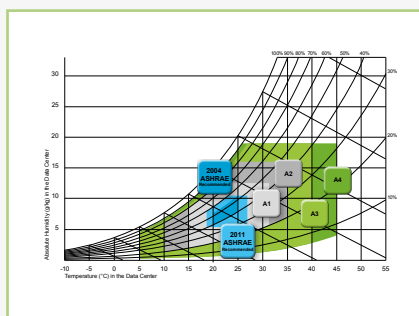
External Air Is too Hot to Achieve 100% Cooling with Adiabatic, the DX Module Is thus Integrated to Cover the Missing Capacity

The State-of-the-Art Liebert® iCOM™ Control

Precise, User-friendly Information at Unit Level

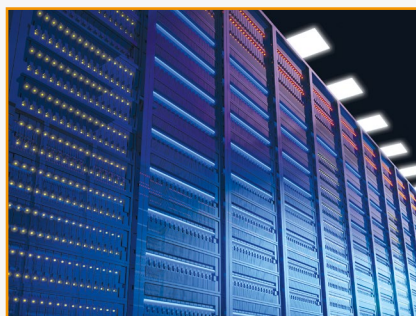
To guarantee ASHRAE recommended guidelines even at extreme conditions

- Extreme Winter Operation (i.e. below -20°C) can cause the unit's unrequired internal dehumidification causing it to exceed ASHRAE recommended minimum humidity. Liebert® EFC offers a constant control of data center air via its integrated Liebert® iCOM™ control logic, ensuring dew point temperature is lower than heat exchanger surface temperature, thus avoiding unrequired dehumidification.



To provide precise temperature and airflow control in front of servers

- The Vertiv SmartAisle™ control logic embedded in the Liebert® iCOM™ optimizes internal air volumes and temperatures according to specific server needs. Vertiv SmartAisle logic allows Liebert EFC to exactly match the servers' airflow needs, ensuring that not even a single Watt is wasted in moving or cooling unrequired air.



To optimize water and electricity costs with the Cost Function software feature

- The user friendly Liebert® iCOM™ Control exploits the management of energy and water also at teamwork level. The system collects information from the different units' key parameters and operating modes (dry, wet and DX/CW) while taking into account water and electricity costs. The control predictively calculates and then implements the combination which optimizes operating costs.



Utmost Efficiency Even at the Data Center System Level

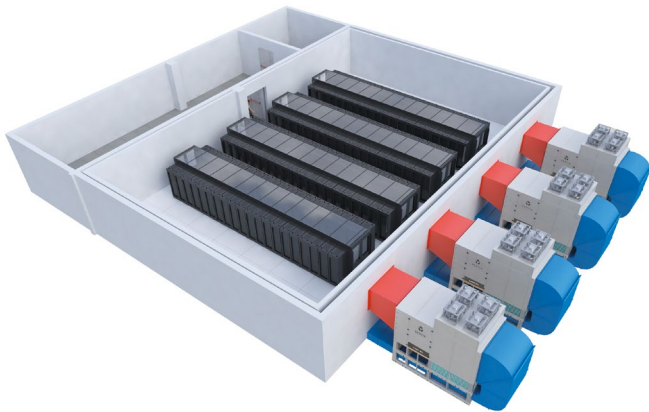
The Liebert® iCOM™ Control manages the operation of the Liebert EFC units, in order to ensure top reliability in all conditions. Access to the units installed in the data center, is granted through the Ethernet connection, that is capable of coordinating the multiple on-site installations. The high-level supervision of multiple units allows these to work together as a single system, thus optimizing overall system performance.

High Flexibility Matching Customer Needs

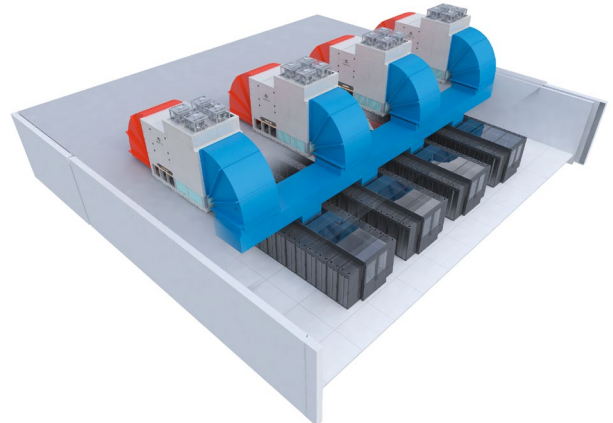
The Liebert® EFC delivers substantial reductions and savings in terms of electrical infrastructure and equipment. With the unit being installed externally, the available internal white space is maximized ensuring ease of system installation. All of these features significantly reduce data center TCO.

Main Options Available	Benefits
DX or CW coil for mechanical cooling integration	Water storage reduction Dehumidification availability Premium efficiency Delivery temperature guaranteed also under the worst ambient conditions
G4 or M5 data center air filter	State-of-the-art filtration class
Low ambient kit	To avoid unrequired dehumidification at very low ambient temperatures
Automatic transfer switch with intelligent controller	Due to the communication with the unit control, all the electrical power data is monitored through the BMS
UltraCapacitor	Control always active even during a power failure
Monitoring	Integrated BMS interface (i.e. ModBus, Bacnet and SNMP)
Energy meter/water meter	To manage energy and water consumption, thus optimizing operating costs
Right and left versions available in both perimeter and roof configurations	To adapt to any data center layout

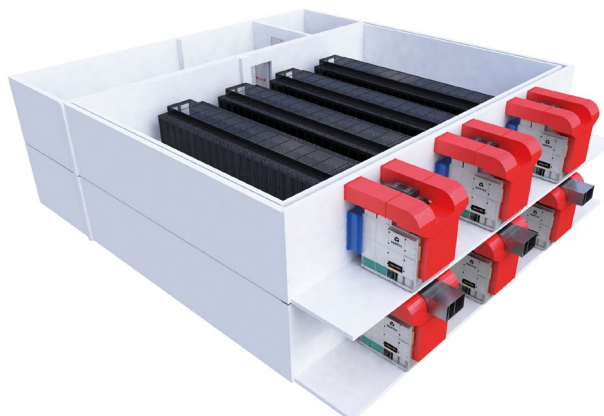
Perimeter Configuration



Roof Configuration



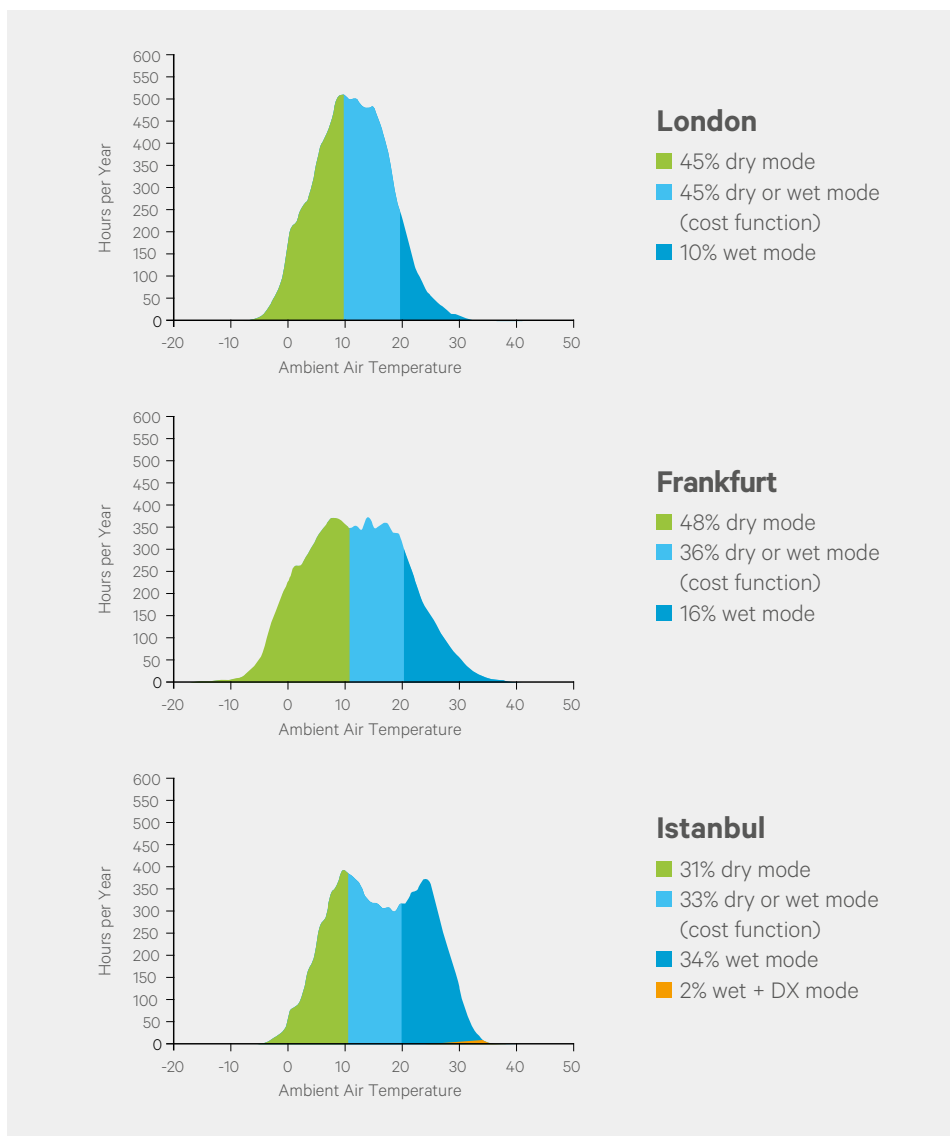
Multi-Storey Configuration



Annual Distribution of Operating Modes with Indirect Evaporative Freecooling

While respecting ASHRAE guidelines, the Liebert® EFC unit can be installed not only in cold climates, where the unit can leverage on the dry operating mode, but also in hotter ones (as shown in the example below for Istanbul) where DX operation is reduced to a minimum and used only during extreme temperature peaks that may be experienced throughout the year. This results in a significant reduction in electrical consumption possible even at full load (reaching the highest possible savings at partial loads).

The Liebert EFC Cost Function optimizes running costs (water and electricity), and according to the external dry bulb and heat load, selects the most convenient working mode (i.e. dry vs. wet). With the same logic, the Cost Function will also optimize the use of the optional Direct Expansion (DX) mode.



Technical Specifications

Model		EFC 220	EFC 300	EFC 320	EFC 400	EFC 440
Net Cooling Capacity 1	kW	203	373	385	425	418
FANS	n°	4+4	9+9	9+6	9+6	9+8
Maximum Airflow - Data Center Side 2	m³/h	52.500	97.000	100.000	110.000	107.500
Max Wet Bulb - Adiabatic Effect Only 3	°C	21,2	21,8	16,9	19,5	20,4
Max Wet Bulb - Adiabatic + DX Effect 3	°C	29,0	26,2	22,9	26,5	28,6
Adiabatic Capability		High	High+	Medium	Medium	High
DX Capability Ratio		High	Medium	Medium	High	High+
Dimensions						
Length	mm	4000	4500	3650	3650	4620
Depth	mm	2300	2900	2900	3400	3400
Height	mm	4050	4700	4700	4700	4600

¹ Return air temperature: 36°C RH=25%; Supply air temperature: 24°C - considering maximum airflow condition below.

² ESP = 0 Pa data center and process side.

³ Maximum wet bulb temperatures to provide the above net cooling capacities.

Vertiv™ LIFE™ Services Remote Diagnostic and Preventive Monitoring

Vertiv's service program is designed to ensure that your critical power protection system is maintained in an optimum state of readiness at all times.



The **Vertiv™ LIFE™ Services** Remote Diagnostic and Preventive Monitoring provides early warning of UPS conditions and out of tolerances. This allows effective proactive maintenance, fast incident response and remote trouble shooting, giving customers complete security and peace of mind. With **Vertiv LIFE Services** you will benefit from:

Uptime Assurance

Constant monitoring of UPS parameters, thus maximizing the system's availability.

First Time Fix Rate

Pro-active monitoring and data measuring ensure that when our

customer engineers are dispatched on-site, they arrive prepared for first time resolution.

Proactive Analysis

From Vertiv LIFE Services centers, our experts proactively analyze the data and trends of your equipment, to recommend actions to ensure their best performance.

Minimized Total Cost of Ownership of Your Equipment

The continuous monitoring of all relevant parameters in turn maximizes unit performance, reduces on-site maintenance and extends the life of your equipment.

Fast Incident Response

Vertiv LIFE Services allows for immediate definition of the best course of action, as a result of the regular communication between your **Liebert® EFC** unit and our **Vertiv LIFE Services** centers. Reporting

You will receive a comprehensive report detailing the working order of your equipment and its operational performance.

Reporting

You will receive a comprehensive report detailing the working order of your equipment and its operational performance.

Customer Experience Center

Thermal Management

Vertiv's Customer Experience Center located in Tognana (Padova - Italy), is specifically designed for customers to interact with Thermal Management data center technologies.

The center gives our customers the unique opportunity to witness pre-installation demonstrations, covering technical performance, interoperability and efficiency of Thermal Management solutions under a broad range of real field conditions.

Customers visiting the center may also benefit from a comprehensive consultation from our R&D, engineering and application specialists.



Evaporative Cooling Validation Area

Our Thermal Management Customer Experience Center features a dedicated area to test the state-of-the-art Liebert® EFC unit.

The scope of the Evaporative Cooling Validation Area is to provide customers, consultants and data center specialists with the most complete testing area to experience the capabilities of our evaporative technology at peak conditions.

Testing parameters include IT loads up to 450 kW and an airflow of up to 120,000 m³ per hour, replicating typical peak conditions across the EMEA region, and an exceptional performance measurement accuracy within a +/- 5% maximum tolerance and a +/- 2% airflow tolerance. Airflow rate is also measured at the outlet side using calibrated intake nozzles in compliance with ANSI-AMCA 210/07 and ISO5801.

All our measuring tools are also periodically tested to adhere to the current international quality procedure ISO9001. This guarantees that all our

measurements are in line with the metrological laboratories' standards (Accredia/EA/ILAC) and that our equipment precision level is also compliant with the European EN14511 standard.

Every customer visit is accompanied by a complete final report which includes

each and every tested parameter. Customers are guided through a first-hand experience with full transparency and flexibility enabling them to achieve the highest standards of technical excellence.



Thermal Management Data Center Infrastructure for Small and Large Applications



Liebert® HPC

Wide range of high efficiency Freecooling Chillers from 40 kW to 1600 kW

- Designed specifically for data center applications and to work with Vertiv™ SmartAisle™
- Premium energy efficiency version
- Unique control capabilities with the Liebert® iCOM™ Control.

Liebert® HPM

Room cooling air conditioners available from 4 to 30 kW



Liebert® PDX Liebert® PCW

Available from 5-220 kW

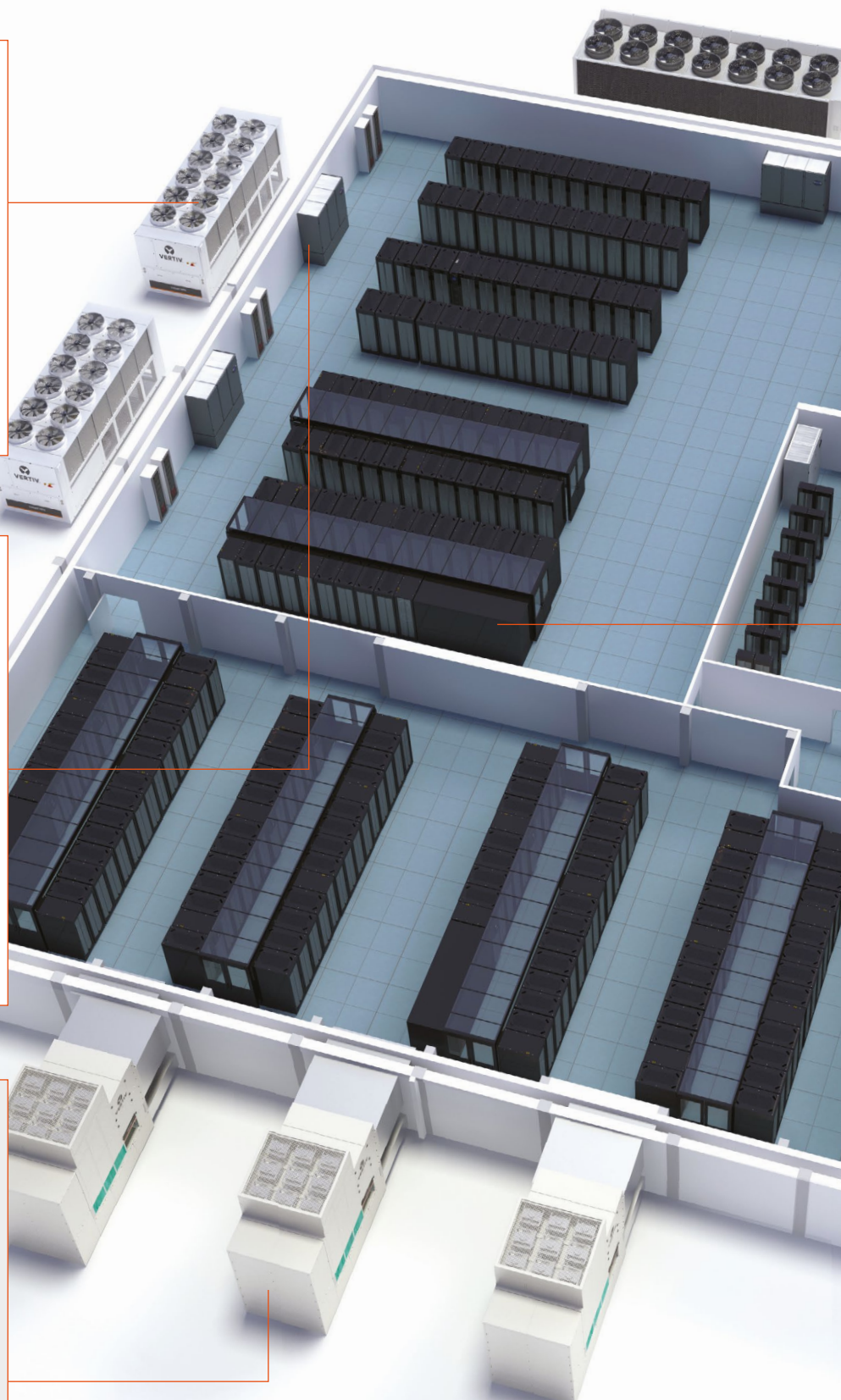
- Premium energy efficiency
- Eurovent certified performance
- Unique control capabilities with the Liebert® iCOM™ Control
- Liebert EconoPhase™ available for the direct expansion system and inverter driven compressors models.



Liebert® EFC

Indirect evaporative freecooling unit leveraging on data center know-how. Available from 100 to 450 kW

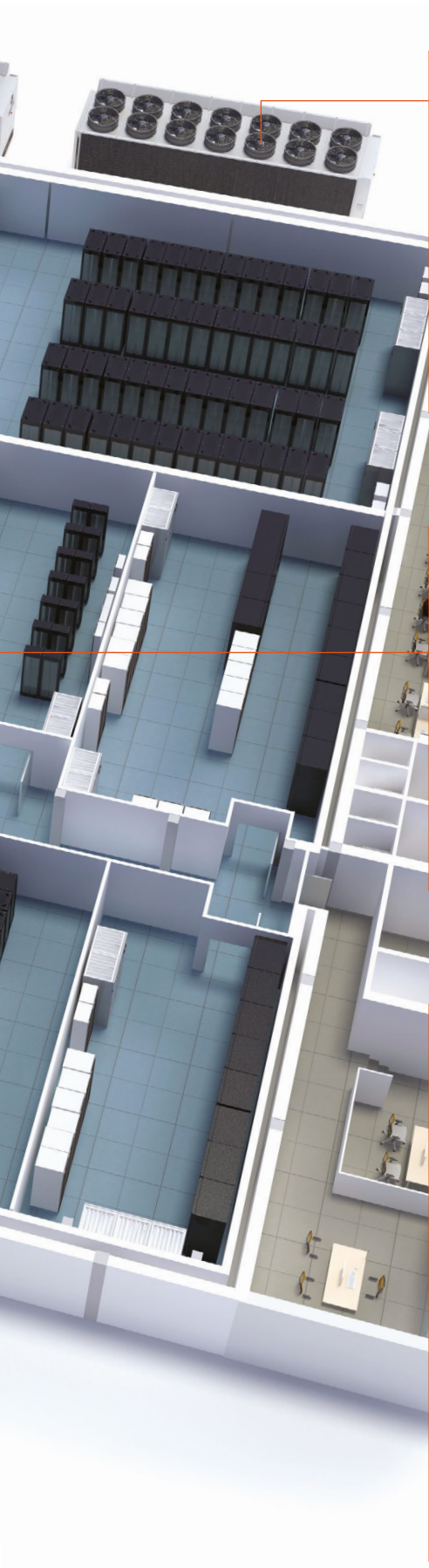
- Unique control capabilities optimizing water and energy costs
- Substantial reductions and savings in terms of electrical infrastructure.



Service and Software Solutions

Vertiv™ supports any application with an extensive service offering including installation, start-up, commissioning, maintenance, replacements, 24/7 remote monitoring and diagnostics and much more.

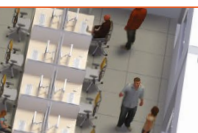
Our remote diagnostics and preventive monitoring LIFE Service is adding value providing actual information to take decisions, as it allows early detection of anomalies and immediate reaction in case of alarms.



Liebert® AFC

The Adiabatic Freecooling Chiller available from 500-1700 kW

- Integrated adiabatic pad system
- High freecooling capacity
- 100% compressor back up.



Vertiv™ SmartAisle™

- Aisle containment
- Provides highest energy efficiency
- Works with any Liebert Thermal
- Management unit.

Liebert® HPW

High performance wall mount outdoor package cooling system from 5 to 5 kW.



Liebert® HPS

Split system from 5 to 4 kW including an indoor evaporating unit and an outdoor compressorized condenser.



Liebert® HPF

Floor-mount package indoor cooling system from 5 to 5 kW.





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